

# Topical Panel on DOE HEP Computing: Report

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- **HEP History in Computing:** Agency support for HEP computing has a long history; current achievements and excellence are the result of a continuous development driven by scientific necessity
- **Role at the Forefront:** Science demands show no sign of declining -- HEP must remain at the vanguard of technology innovation and in the role of “first adopter” of emergent technologies

Presented by Salman Habib at P5 Town Hall Meeting, SLAC, December 2, 2013

# Topical Panel on DOE HEP Computing

- **Topical Panel meets in Washington DC, Dec 9-11:** Ongoing activity involves ~35 participants, based on charge letter from Jim Siegrist (OHEP Associate Director)
- **Key Elements of Charge Letter:**
  - Identify cross-cuts across the HEP computing program that can benefit from common solutions
  - Identify opportunities for R&D with high programmatic impact, including international leadership
  - Survey HEP software and identify actions related to maintenance/updating, gaps, non-HEP partnerships, and lifecycle management
  - Survey current computing and data management practice across HEP -- can an improved structure accelerate the progress of science?
  - Survey use of hardware, identify opportunities for increased efficiency, cost effectiveness, and application of the best technologies
  - Identify opportunities presented by establishing a (virtual/distributed) Center for HEP Computing Excellence
- **Key Topical Panel Activities:**
  - Gather/organize information and use Snowmass community studies (plus other recent documents) to provide:
    - Specific program data (overall view of activities and infrastructure) to DOE HEP
    - Suggest action plans to improve overall effectiveness of current and future computing-based activities in DOE HEP

# Computing and DOE HEP

- **Fundamental Role of Computing:** Computing now underlies ALL of science, but its role in HEP is pervasive and unique
- **HEP and “At-Scale” Computing:**
  - High Throughput and Distributed/Grid Computing
  - Online Data Processing (not covered here)
  - High Performance Computing
  - High Performance Networking
  - Large-Scale Data Storage
  - Large-Scale Data Management and Analysis
  - Global Scale of Operations
- **HEP Computing Effort and Topical Panel Drivers**
  - Major investment in people and infrastructure (strong interaction with NSF)
  - Increase effectiveness -- more global vs. local optimizations
  - Increase responsiveness to near-future drivers -- science focus changes, technology evolution in computing and storage hardware, era of limited funding
  - How to best leverage HEP expertise -- and best interact with other science domains and industry -- to address the above two bullets

# Topical Panel Organization

- **DOE HEP:** Charge from Jim Siegrist (Associate Director, OHEP); responsible program managers: Lali Chatterjee and Larry Price (OHEP)
- **Co-Chairs:** Paul Avery (Florida) and Salman Habib (Argonne)
- **Advisory Panel:** Amber Boehnlein (SLAC), Rob Roser (Fermilab), Heidi Schellman (Northwestern), Stephen Sharpe (Washington), Craig Tull (LBNL), Torre Wenaus (Brookhaven)
- **Subpanels (input also provided by other topical experts):**
  - **Accelerators:** Cho Ng (SLAC), Robert Ryne (LBNL), Tor Raubenheimer (SLAC/Stanford), Panagiotis Spentzouris (Fermilab), Jean-Luc Vay (LBNL)
  - **Cosmic Frontier:** Anders Borgland (SLAC), Andrew Connolly (Washington), Gus Evrard (Michigan), Cristiano Galbiati (Princeton), Peter Nugent (LBNL), Martin White (Berkeley)
  - **Energy Frontier:** Lothar Bauerdick (Fermilab), Chip Brock (Michigan State), Kaushik De (UT Arlington), Steven Gottlieb (Indiana), Stefan Hoeche (SLAC), Tom LeCompte (Argonne), Dan Marlow (Princeton), Harvey Newman (Caltech)
  - **Intensity Frontier:** Bob Bernstein (Fermilab), Milind Diwan (Brookhaven), Paul Mackenzie (Fermilab), Mayly Sanchez (Iowa State), Malachi Schram (PNNL)
  - **Technology:** Andrew Chien (Chicago), Michael Ernst (Brookhaven), Paul Messina (Argonne), Inder Monga (ESnet), Richard Mount (SLAC), Don Petravick (NCSA), David Skinner (NERSC)

# Information Sources/Action Items

- **Snowmass Reports:** Extensive coverage in Snowmass Reports and White Papers (e.g., Computing Frontier: Storage and Data Management Report, OSG White Paper, etc.)
- **ESnet:** HEP and NP Network Requirements (August 2013)
- **ASCR/HEP:** ASCR/HEP Data report and ASCR Crosscutting Requirements Review (April 2013)
- **HEP/NERSC:** Large Scale Production Computing & Storage Requirements for HEP: Target 2017
- **Subpanel “One-Pagers”:** Mini-docs on computing topics and specific activities (e.g., codes)
- **Other:** Industry reports, NRC panel ‘Big Data’, ASCR ASKD, etc., total of ~200 documents
- **Topical Panel Action Items: Task List for Initial Report**
  - **Outline Current Activities** -- Role of computing within relevant HEP programs as a science driver; scale, depth, and evolution of the computing program; organization of HEP computing; software, including lifecycle management and gap analysis; role of networking; HEP hardware capabilities, etc.
  - **Roadmapping Strategy** -- Identification of cross-cuts; next-generation hardware and software; overall organization; outreach to other science domains and industry, etc.
    - **First Level:** Initial aim of Topical Panel is a ‘high level’ report with the aim of identifying key focal areas, not so much to present ‘instant solutions’, but to outline advantageous future paths and to identify potential challenges
    - **In-Depth Studies:** Based on the first set of conclusions, the Topical panel will suggest a number of more detailed studies to address important specific goals

# Representative Subpanel Activities and Cross-Cuts

- **Accelerators:** Sustainability of modeling software, collaborations with other frontiers, code integration, conversion of code base to next-generation HPC systems, --
- **Cosmic Frontier:** Cross-cuts with Intensity Frontier for dark matter experiments, data analysis and management pipelines, 'big data' support, use of HPC and network resources, --
- **Energy Frontier:** Cross-cuts with Intensity Frontier, next-generation hardware issues, use of HPC for Energy Frontier experiments, LHC Run II, --
- **Intensity Frontier:** Diverse set of requirements from Intensity Frontier experiments, connection to Energy Frontier activities, opportunity for new developments, --
- **Technology:** Opportunities for collaborations with ASCR facilities, next-generation hardware/software, adoption of cloud technologies, --
- **Cross-Cuts Discussion Points:** How can the development of common tools reduce redundancies in the system, yet allow for flexibility to undertake new approaches?, --
  - Timelines of experiments must be respected/supported
  - Future focus -- better integration with activities outside of HEP in terms of software practices, data management, and hardware utilization
  - Training processes need to be improved (students, postdocs, faculty, staff)

# Summary

- **Key Suggestion:** (Eventually) organize computing as a core competency of DOE HEP with continued essential input from the community (Snowmass, P5, --)
- **Computing as a Competency:** Rich interaction between experiments and computing efforts must continue, but computing as a resource should not be purely “vertical”, horizontal elements need to be added (common resources/tools, uniform standards, broad-based planning, explicit management of software/hardware/data lifecycles)
- **Possible Organization in 3 Components:**
  - **R&D:** Managing technology change in computing, networking, and data storage hardware, joint programs with other offices/entities (ASCR, NSF, BES, --), (distributed) Center for Computational Excellence
  - **Operations:** Discharge computational infrastructure-related responsibilities, maintain essential software, be responsible for training programs, and for data preservation and curation
  - **Planning:** Investment policies, e.g., 5-year cycles, work jointly with experiments/projects across Frontiers

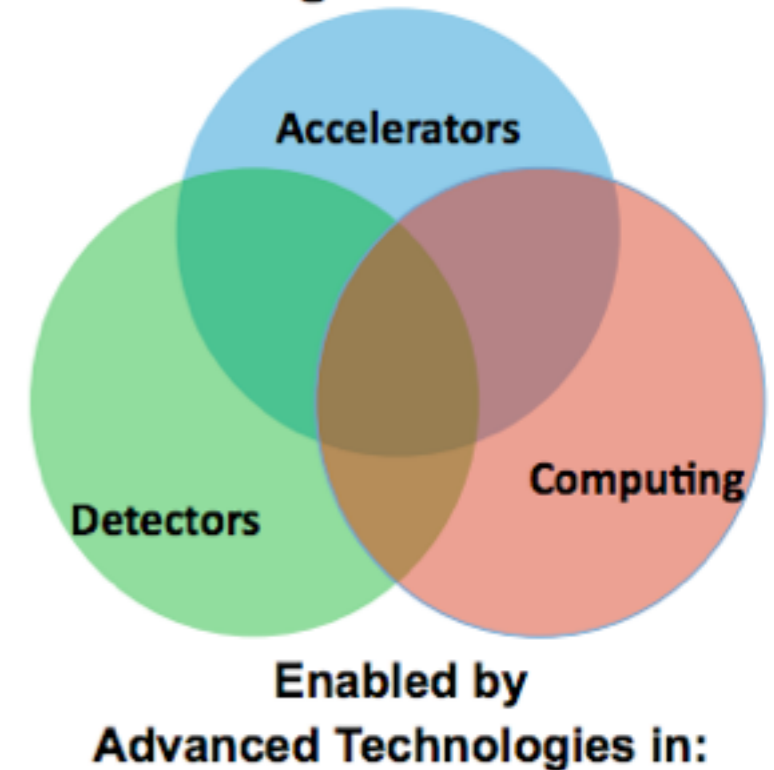


Figure from a talk by  
Jim Siegrist